

Installation, Start-Up and Service Instructions

Sizes 055-115

NOTE: Remove the Energy Guide tag from the furnace when the installation is complete.

NOTE: This is a highly specialized piece of equipment. Before beginning the installation, READ THESE INSTRUCTIONS CAREFULLY AND COMPLETELY.

INTRODUCTION

Before installing the furnace, refer to "Procedure for Induced-Combustion Furnaces" (packaged with the equipment) for information concerning combustion, venting, piping, and other standard installation practices. Further reference is made to the current edition of the National Fuel Gas Code NFPA No. 54, TIA-54-1984-1/ANSI Z223.1-1984, Z223.1a-1987 and American Gas Association.

The induced-combustion vent system of this furnace is designed to operate at zero or negative pressure at the vent connector outlet. This furnace, therefore, complies with the National Fuel Gas Code (NFPA No. 54, TIA-54-1984-1/ANSI Z223.1-1984, Z223.1a-1987), Part 7.3.4.b. This furnace is also listed by A.G.A. for use with the type B1 gas vent, as described in the National Fuel Gas Code, Part 7.4.2.

Each furnace is shipped from the factory completely assembled with multispeed direct-drive blower and wired ready for indoor heating installation. All sizes feature a blower control center with easy-to-read low-voltage terminal strip to ensure proper connections.

Table 1—Clearances (In Inches)

Sizes	055	075 thru 115
DOWNFLOW (In Alcove or Closet)		
Sides—Single-Wall Vent	1	0
Type-B1 Double-Wall Vent	0	0
Back	0	0
Top	1	1
Front*—Single-Wall Vent	6	6
Type-B1 Double-Wall Vent	3	3
Vent—Single-Wall	6	6
Type-B1 Double Wall	1	1
HORIZONTAL (In Alcove)		
Sides†	1	0
Back	0	0
Top—Single-Wall Vent	1	1
Type-B1 Double-Wall Vent	0	0
Front*	18	18
Vent—Single-Wall	6	6
Type-B1 Double-Wall	1	1
HORIZONTAL (In Closet)		
Sides†	1	1
Back	3	3
Top—Single-Wall Vent	2	2
Type-B1 Double-Wall Vent	2	2
Front*—Single-Wall Vent	6	6
Type-B1 Double-Wall Vent	3	3
Vent—Single-Wall	6	6
Type-B1 Double-Wall	1	1

*Provide a 30-in. service clearance in front of the furnace.

†Indicates supply or return sides when furnace is in the horizontal position.



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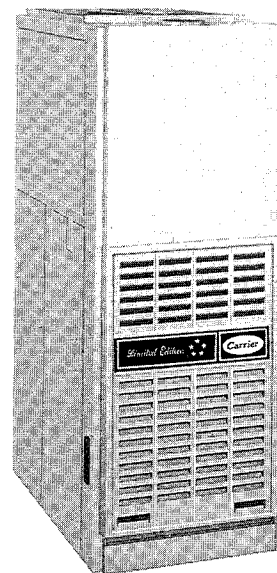


Fig. 1—Downflow

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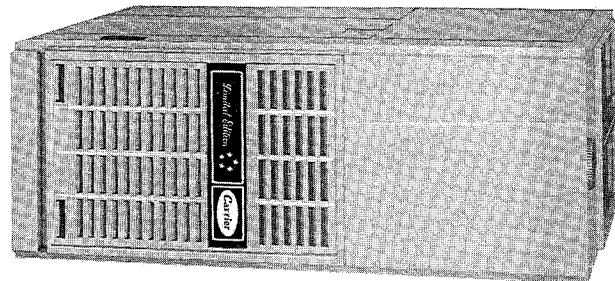


Fig. 2—Horizontal

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The output capacity and any representations of efficiency for this product are based on standard Department of Energy test procedures. The installed operation may vary, depending on installation, weather, or other factors.

▲ CAUTION

Do not install furnace in a corrosive or contaminated atmosphere. Make sure all combustion and circulating air requirements listed in "Procedure for Induced-Combustion Furnaces" are adhered to, in addition to all local codes and ordinances.

Do not use this furnace during construction when adhesives, sealers, and/or new carpets are being installed. If the furnace is required during construction, use clean outside air for combustion and ventilation. Compounds of chlorine and fluorine when burned with combustion air form acids which will cause corrosion of the heat exchangers and metal vent system. Some of these compounds are: paneling and dry wall adhesives, paints, thinners, masonry cleaning materials, and many other solvents commonly used in the construction process.

Manufacturer reserves the right to discontinue, or change at any time, specifications or designs without notice and without incurring obligations.

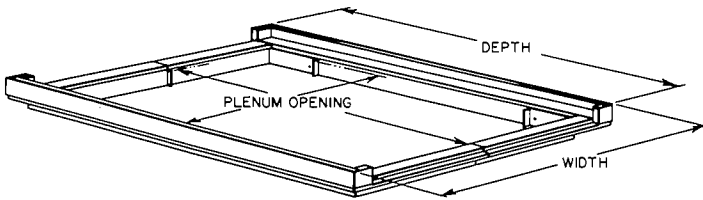


Fig. 6—Combustible Floor Base

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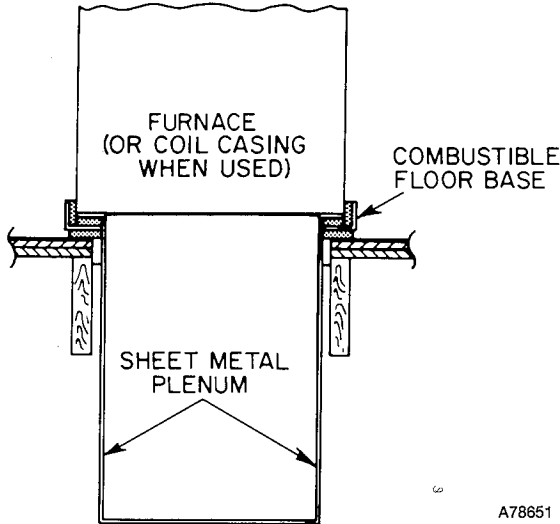


Fig. 7—Furnace, Plenum, and Base Installed on a Combustible Floor

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2. Cut and frame hole in floor per dimensions in Table 1 of Installation Instructions packaged with combustible floor base. If this requires cutting of a floor joist, tie ends of cut joist into adjacent joists so that proper floor support will be maintained.
3. Assemble and install combustible floor base per instructions packaged with base.
4. When completed, combustible floor base, plenum, and furnace (or coil casing when used) should be installed as shown in Fig. 7.

VI. HORIZONTAL ATTIC INSTALLATION

▲ WARNING

Do not install the furnace on its back. Fusible link operation will be adversely affected. Never connect return-air ducts to the sides or back of the furnace. A failure to adhere to this warning can cause a fire, physical injury, or death.

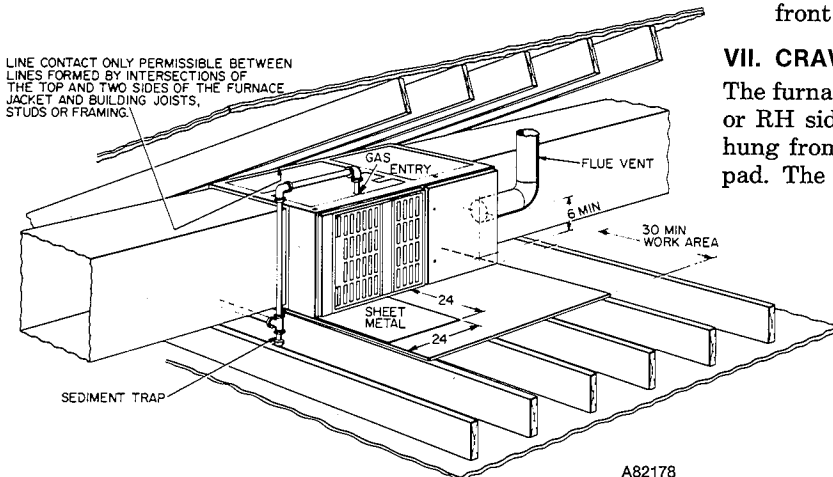


Fig. 8—Typical Attic Installation

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The furnace can be installed horizontally on either the LH or RH side. A typical attic installation is shown in Fig. 8.

NOTE: The National Fuel Gas Code requires the use of a type B1 vent in an attic or concealed space.

A. Construct a working platform.

1. Place working platform in location where all required furnace clearances are obtainable. See Table 1.
2. Use materials in platform that will support installer and service persons.
3. Secure platform to building joists.

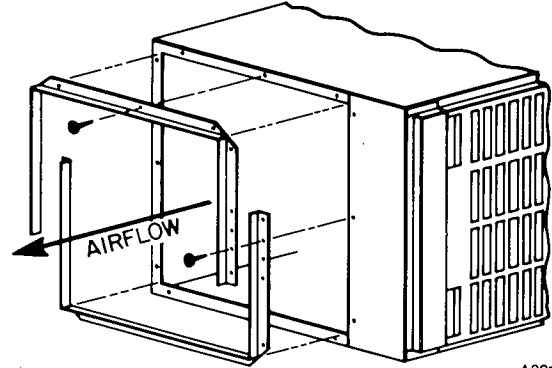


Fig. 9—Duct Flange Installation

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B. Install furnace

1. Position furnace in desired location.
2. Connect gas supply pipe. See Fig. 8 for typical piping entry. It is important to install a sediment trap in the gas pipe riser.
3. Connect supply- and return-air ducts.
 - a. Install field-supplied duct flanges as shown in Fig. 9.
 - b. Using appropriate fasteners for type of supply-air duct being used, connect duct to furnace.
 - c. Install field-supplied filter retainers as indicated in Fig. 10 and Table 5 before connecting return-air duct to furnace.

NOTE: For ease of servicing, a return-air filter can be installed in a common return-air grille. The air velocity rating must not exceed 300 ft/min for disposable filters. The air velocity through permanent-type filters shall not exceed the manufacturer's recommendation.

- d. Using appropriate fasteners for type of duct being used, connect return-air duct to furnace.
4. Install 24-x24-in. sheet metal shield on platform in front of louvered control panel, as shown in Fig. 8.

VII. CRAWL SPACE INSTALLATION

The furnace can be installed horizontally with either the LH or RH side up. In a crawl space, the furnace can either be hung from the floor joist or installed on suitable blocks or pad. The furnace can be suspended from each corner by

hanger bolts (Four each $\frac{3}{8}$ -in. all-thread rod) cut to desired length, 1 x $\frac{3}{8}$ flat washer, $\frac{3}{8}$ lockwasher, and $\frac{3}{8}$ nut. Dimples are provided for hole locations. See Fig. 3.

NOTE: Use Type B1 vent in a concealed space.

The crawl space installation is very similar to the attic; therefore, refer to Division VI, Section B, steps 1, 2, and 3. The installation of a sheet metal shield in front of the louvered control panel is covered in step 4. For a crawl space installation, this same sheet metal shield must be installed above the louvered control panel. Extend the sheet metal shield over the furnace top far enough to cover the gas pipe entry hole.

VIII. FILTER ARRANGEMENT

The two factory-supplied filters are shipped in the blower compartment. After the return-air duct has been connected to the furnace, install the filters in a V-formation inside the return-air plenum. See Fig. 10 and Table 5 for horizontal applications. See Fig. 11 for downflow applications.

⚠ WARNING

Never operate unit without a filter or with filter access door removed. A failure to adhere to this warning can cause a fire, physical injury, or death.

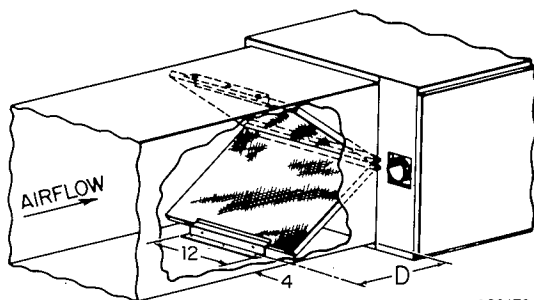


Fig. 10—Horizontal Filter Arrangement

Table 5—Filter Retainer

Furnace Casing Width	D
14 $\frac{3}{16}$	15 $\frac{3}{16}$
17 $\frac{1}{2}$	14 $\frac{1}{2}$
21	13 $\frac{3}{16}$
24 $\frac{1}{2}$	12 $\frac{1}{4}$

IX. SEQUENCE OF OPERATION

Using the schematic wiring diagram, Fig. 12, trace the sequence of operation for the heating cycle is as follows:

1. When the blower door is in place, 120 volts is supplied through blower door interlock switch 9G. Transformer 1A is energized, supplying 24 volts to heating-blower relay coil 2E, which opens normally closed blower relay contacts 2E in the low-speed circuit of blower motor 3D.
2. The wall thermostat "calls for heat," closing the R and W circuit. This closed circuit supplies power to the 24-volt safety circuit containing limit switch 7H1, fusible link 11C, manual-reset draft-safeguard switch 7H2, and manual reset auxiliary switch 7H3.
3. Simultaneously, the pilot solenoid coil of gas valve 5F, spark generator 6F, and inducer-motor relay coil 2D are energized. Inducer-motor relay contacts 2D in the 120-volt circuit close, starting inducer blower motor

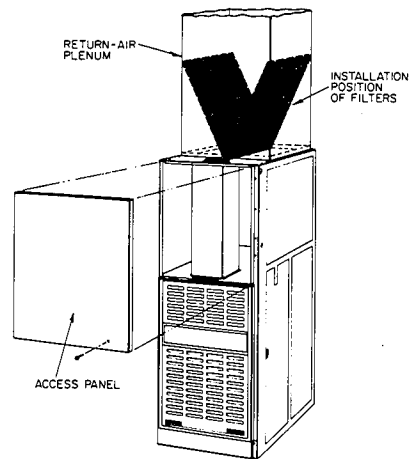


Fig. 11—Position of Filters

3A. Also, another set of contacts in inducer-motor relay 2D close in the 24-volt circuit, and lock in inducer-motor relay coil 2D. The coil is locked in until the R and W circuit or safety circuit opens.

4. When the pilot solenoid coil of gas valve 5F is energized, gas flows to the pilot. The pressure switch within the gas valve senses the pilot gas pressure and closes. The pilot gas is ignited by a spark produced by spark generator 6F. Simultaneously, inducer motor 3A comes up to speed, actuating flow sensing switch 7V, which supplies 24 volts to the hold circuit of gas valve 5F. After a short delay, the normally closed contacts of the pilot-flame sensing switch 6H opens. The pilot solenoid coil remains energized through the hold circuit, while the spark generator 6F shuts off within a few seconds after flame is sensed at the spark electrode. The normally open pilot-flame sensing contacts close 5 to 20 seconds later, making the circuit to the MVG (Main Operator) of gas valve 5F. Gas valve 5F opens 6 to 15 seconds later allowing gas flow to the main burners, which are ignited by pilot 6H. Simultaneously, time-delay circuit 11L in the blower control center is energized. Approximately 50 seconds after gas valve 5F opens, heating relay coil 2E is deenergized, which closes the 120-volt contacts of heating relay 2E, starting blower motor 3D on its heating speed.
5. When the thermostat is satisfied, the circuit between R and W is broken, deenergizing gas valve 5F, inducer motor relay 2D, and the solid-state time-delay circuit on the printed-circuit board. The gas flow stops immediately to the pilot and main burners. After approximately 105 seconds, heat relay 2E is energized and blower motor 3D stops.

NOTE: After a brief interruption of either electric or gas supply, the furnace will not resume operation until the contacts of pilot-flame sensing switch 6H move from the normally open to the normally closed position.

Cooling Cycle

1. The wall thermostat "calls for cooling."
2. The R, G, and Y circuits are energized. Simultaneously, the R-and-Y circuit starts the outdoor condensing unit, and the R-and-G circuit energizes cooling relay coil 2F, which closes normally open contacts 2F, energizing the cooling speed winding of motor 3D and opening the normally closed contacts of cooling relay 2F.

X. ELECTRICAL CONNECTIONS

A. Line-Voltage Wiring

IMPORTANT: Before proceeding with the electrical connections, make certain that voltage, frequency, and phase

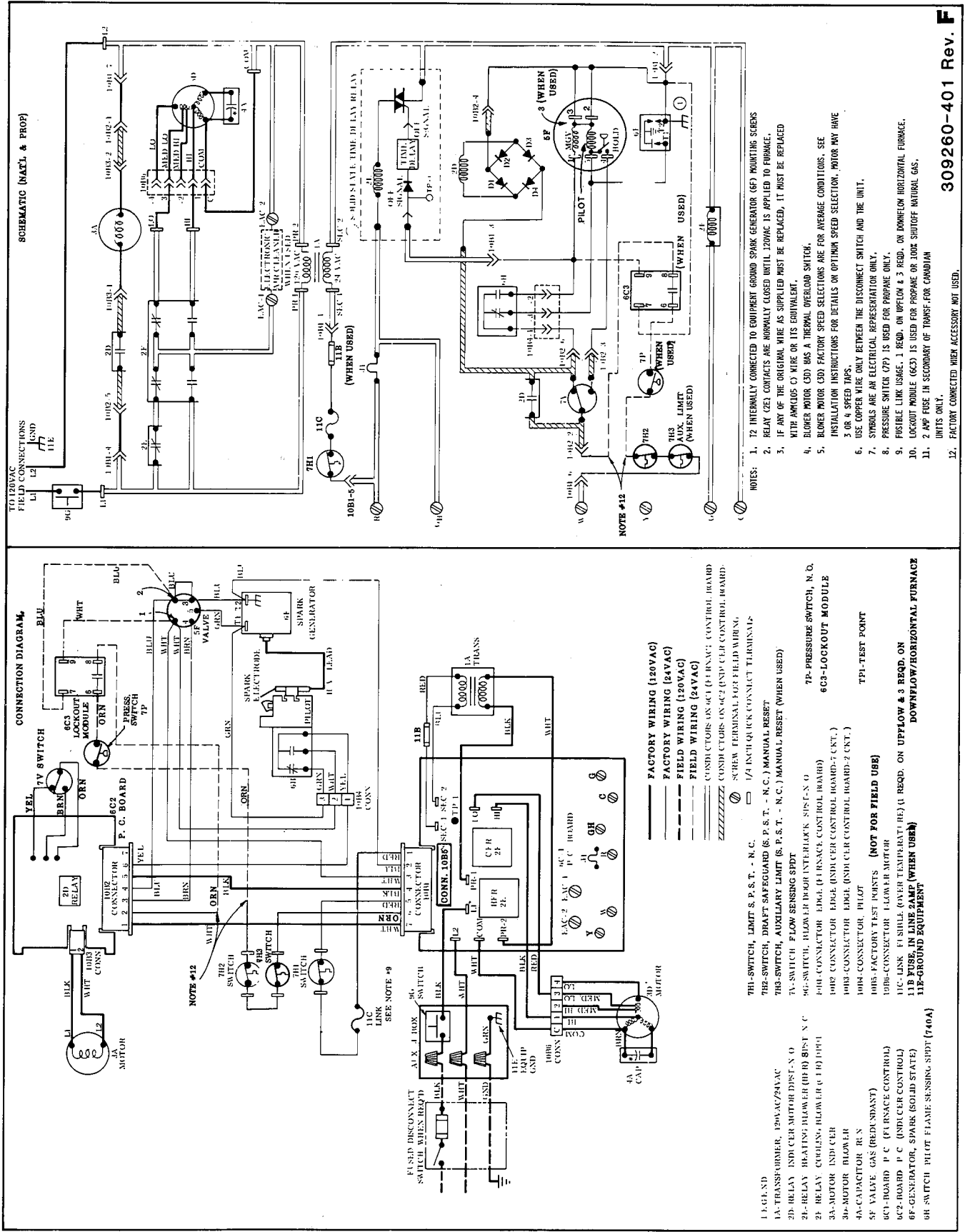
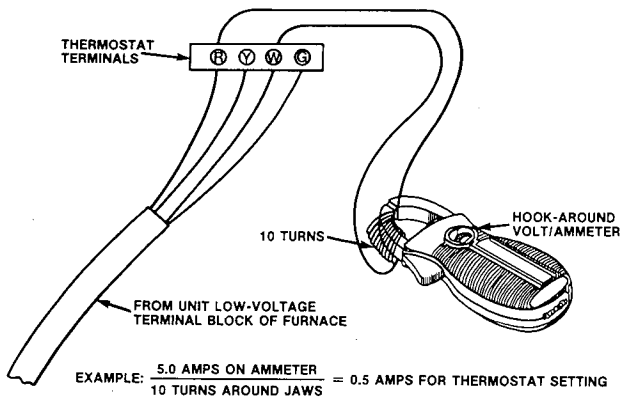


Fig. 12—Wiring Diagram



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Fig. 13—Amp Draw Check With Ammeter

correspond to that specified on the unit rating plate. Also, check to be sure that the service provided by the utility is sufficient to handle the additional load imposed by this equipment. Refer to the unit rating plate for equipment electrical requirements.

CAUTION

Do not connect aluminum wire between disconnect switch and furnace.

See Fig. 15 for wiring diagram showing the proper field high- and low-voltage wiring. Make all electrical connections in accordance with the National Electrical Code and any local codes or ordinances that might apply.

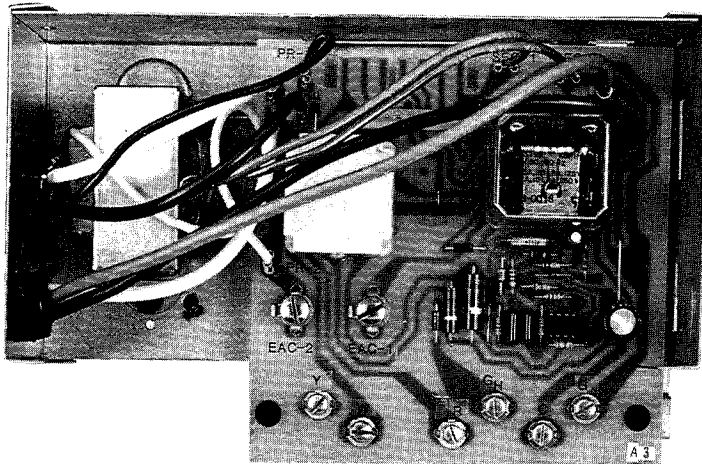


Fig. 14—Blower Control Center

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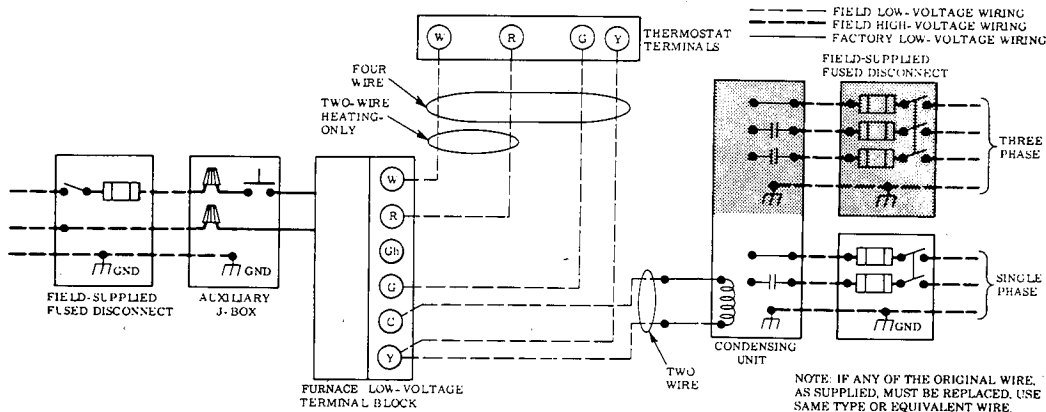


Fig. 15—Heating and Cooling Application Wiring Diagram

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Use a separate fused branch electrical circuit containing a properly sized fuse or HACR-type circuit breaker for this furnace. A disconnecting means must be located within sight of, and readily accessible to, the furnace. The blower door switch may be acceptable in some areas as a disconnecting means.

WARNING

The cabinet must have an uninterrupted or unbroken ground according to National Electrical Code, ANSI/NFPA 70-1987, or local codes to minimize personal injury if an electrical fault should occur. This may consist of electrical wire or conduit approved for electrical ground when installed in accordance with existing electrical codes. Do not use gas piping as an electrical ground. A failure to adhere to this warning can result in an electrical shock, fire, or death.

If line-voltage wiring to the unit is encased in a nonmetallic sheath, connect the incoming ground wire to the grounding wire inside the furnace J-box. If metallic conduit is used, it will serve as the ground.

B. Low-Voltage Wiring

NOTE: When installing a Carrier thermostat P/N TST01 and relay system P/N TSR01, follow the instructions packaged with the thermostat and relay for installation procedures.

Make field low-voltage connections at the low-voltage terminal strip. See Fig. 15.

NOTE: When the furnace is installed in the horizontal position with RH discharge air, low-voltage wire connections can be made easier by removing the two control box mounting screws and letting the control box turn so that the low-voltage screw terminals are visible. Be sure to reinstall the control box after the connections are made.

NOTE: Use AWG No. 18 "color-coded" copper thermostat wire for lengths up to 100 ft. Above 100 ft, use AWG No. 16 wire.

IMPORTANT: The thermostat heat anticipation must be set to match the amp draw of the gas valve and electrical components in the R-W circuit. Accurate amp draw readings can be obtained at thermostat subbase terminals R & W. Fig. 13 illustrates an easy method of obtaining the actual amp draw. The amp reading should be taken after the blower motor has started.

The room thermostat should be located where it will be in the natural circulation path of room air. Avoid locations where the thermostat would be exposed to cold-air infiltration, drafts from windows, doors, or other openings leading

to the outside, or exposed to air currents from warm- or cold-air registers; or to exposure where the natural circulation of the air is cut off—such as behind doors, above or below mantels, shelves, etc.

The thermostat should not be exposed to heat from nearby fireplaces, radios, televisions, lamps, or rays from the sun. Nor should the thermostat be mounted on a wall containing pipes or warm-air ducts, or a flue or vent that could affect its operation and prevent it from properly controlling the room temperature. Any hole in the plaster or panel through which the wires pass from the thermostat should be adequately sealed with suitable material to prevent drafts from affecting the thermostat.

C. Blower Control Center

Each furnace features a blower control center. This will aid the installer and serviceworker when installing and servicing the unit. A low-voltage terminal board is marked for easy connection of field wiring. See Fig. 14.

XI. STARTUP AND ADJUSTMENT

In addition to the following information, refer to "Procedures for Induced-Combustion Furnaces" packaged with the unit.

NOTE: The furnace blower door must be in place to complete the 115-volt circuit to the furnace.

⚠ CAUTION

This furnace is equipped with a fusible link(s) in the vestibule area. The link(s) will melt if an overheating condition caused by an inadequate combustion-air supply or improper venting practices develops. *Do not* jumper the link(s). Correct the condition and replace the link(s) with an identical part.

The gas service pressure must not exceed 0.5 psig (14 in. wc).

NOTE: The gas valve regulator has been factory-set at 3.5 in. wc for natural gas. Refer to "Procedure for Induced-Combustion Furnaces" for readjusting when checking input.

A. Adjustment of Blower Speed

⚠ WARNING

Disconnect the electrical power before changing the speed tap. A failure to adhere to this warning can cause personal injury.

To change motor speed taps, remove the motor tap lead. See Table 6, and relocate it on the desired terminal on the plug-in terminal block/speed selector located on the blower.

Table 6—Speed Selector

Speed	Tap No.*†
Common	C
Hi	1
Med-Hi	2
Med-Low	3
Low	4

*Furnaces without a cooling fan relay are equipped with a 3-speed motor.
†White wire from control box to common; black wire from control box to cooling speed selection (when used); red wire from control box to heating speed selection.

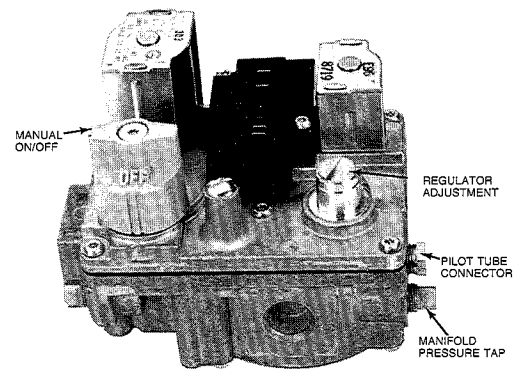
⚠ CAUTION

When adjusting the blower speed, make certain that the temperature rise across the heat exchanger does not exceed that specified on the rating plate.

B. Automatic Gas Control Valve

These units are equipped with an automatic gas control valve. If not already checked when lighting the main burner, check the proper operation of this valve by moving the room thermostat pointer above and below room temperature and observing that the main burners light on "call for heat" (there will be a time delay) and go off when the pointer is moving below room temperature setting.

NOTE: For ease of adjusting the pilot flame, disconnect and tape one power lead at the main gas valve. Disconnect terminal No. 1. This will prevent main burner ignition and allow time to adjust the pilot. Reconnect the power lead after adjustment.



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Fig. 16—Redundant Automatic Gas Control Valve

XII. CARE AND MAINTENANCE

⚠ CAUTION

Because of possible damage to the equipment or personal injury, maintenance should be performed by qualified persons only.

⚠ WARNING

Never store anything on, near, or in contact with, the furnace, such as:

1. Spray or aerosol cans, rags, brooms, dust mops, vacuum cleaners, or other cleaning tools.
2. Soap powders, bleaches, waxes or other cleaning compounds, plastic or plastic containers, gasoline, kerosene, cigarette lighter fluid, dry cleaning fluids, or other volatile fluids.
3. Paint thinners and other painting compounds, paper bags or other paper products. A failure to adhere to this warning can cause a fire, physical injury, or death.

For continuing high performance, and to minimize possible equipment failure, it is essential that periodic maintenance be performed on this equipment. Consult your local Dealer as to the proper frequency of maintenance and the availability of a maintenance contract.

The ability to properly perform maintenance on this equipment requires certain mechanical skills and tools. If you do not possess these, contact your Dealer for maintenance.

▲ WARNING

Turn off gas and electrical supplies to unit before performing any maintenance or service on unit. Follow relighting instructions on label attached to the front of the furnace. A failure to adhere to this warning can cause personal injury.

The minimum maintenance that should be performed on this equipment is as follows:

1. Check and clean or replace air filter each month or as required.
2. Check blower motor and wheel for cleanliness and lubrication each heating and cooling season. Clean and lubricate as necessary.
3. Check electrical connections for tightness and controls for proper operation each heating season. Service as necessary.

▲ WARNING

As with any mechanical equipment, personal injury can result from sharp metal edges, etc.; therefore, be careful when removing parts.

A. Air Filter

Each furnace accommodates two filters which are installed in the return-air duct. See Figs. 10 and 11.

To clean or replace the filters, proceed as follows:

1. Disconnect electrical power before removing access panel.
2. Remove upper access panel.
3. Reach up behind top plate, tilt filters toward center of return-air plenum, remove filters, and replace or clean as needed.
4. Furnaces are equipped with permanent, washable filters. Clean those filters as follows:
 - a. Clean with tap water.
 - b. Rinse and let dry. No oiling or coating of filters is required.
 - c. Reinstall filters with cross-hatch binding facing blower.

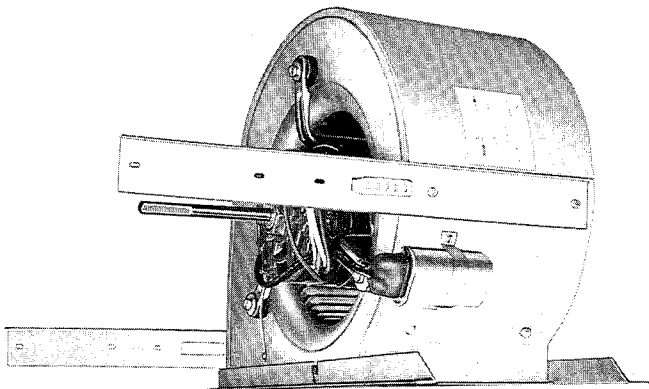


Fig. 17—Dual Blower With Left-Hand Housing and Wheel Removed

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B. Blower Motor and Wheel

1. Remove blower access panel.
2. Remove vent pipe enclosure.
3. Disconnect vent pipe and remove short piece of pipe from furnace.
4. Disconnect wires from auxiliary limit on blower housing.

NOTE: For ease of blower removal, it may be necessary to remove the control box on some sizes.

5. Remove blower assembly from furnace.
6. Remove motor from blower housing.
7. Lubricate motor using good grade of SAE 20 nondetergent motor oil. Put one teaspoon, 5cc, $\frac{3}{16}$ oz., or 16 to 25 drops in each oil port.
8. Remove blower wheel from housing and clean by using vacuum with soft brush attachment. Care must be exercised not to disturb balance weights (clips) on blower wheel vanes.

▲ CAUTION

Be sure the motor is properly positioned in the blower housing. The motor oil ports must be at a minimum of 45° above the horizontal centerline of the motor after the blower assembly has been reinstalled in the furnace.

9. Reassemble furnace by reversing above procedures.

C. Cleaning Heat Exchanger

If it becomes necessary to clean the heat exchanger because of carbon deposits, soot, etc., proceed as follows:

NOTE: Deposits of soot and carbon indicate a problem exists and needs correcting. Corrective action must be taken to correct the problem.

1. Turn off gas and power to furnace.
2. Remove control and blower access doors.
3. Remove vent pipe enclosure and disconnect vent pipe from relief box.
4. Remove four screws that secure relief box to blower shelf.
5. Disconnect two wires from safeguard switch.
6. Disconnect wire harness edge connector from side of inducer control box.
7. Remove eight screws that secure flue collector box to center panel. Use care not to damage sealant.
8. Remove complete inducer assembly from furnace, exposing flue openings.
9. Remove flue choke.
10. Using field-provided small wire brush, steel spring cable, reversible electric drill, and vacuum cleaner; clean cells.
 - a. Assemble wire brush and steel spring cable.
 - (1.) Use 4 feet of $\frac{1}{4}$ -in. diameter high-grade steel spring cable (commonly known as drain cleanout or Roto-Rooter cable).
 - (2.) Use $\frac{1}{4}$ -in. diameter wire brush (commonly known as 25-caliber rifle cleaning brush).

NOTE: The items called for in steps 1 and 2 can be purchased at a local hardware store.

- (3.) Insert twisted wire end of brush into end of spring cable, and crimp tight with crimping tool or strike with ball-peen hammer. *Tightness is very important.*

- (4.) Remove metal screw fitting from wire brush to allow insertion into cable.
- b. Clean each heat exchanger cell.
 - (1.) Attach variable-speed reversible drill to end of spring cable (end opposite brush).
 - (2.) Insert brush end of cable into upper opening of cell and slowly rotate with drill. *Do not* force cable. Gradually insert at least 3 feet of cable into two upper passes of cell. See Fig. 18.
 - (3.) Work cable in and out of cell three or four times to obtain sufficient cleaning. *Do not* pull cable with great force. Reverse drill and gradually work cable out.
 - (4.) Remove burner assembly and flame radiators. (Identify gas valve leads.)
 - (5.) Insert brush end of cable in lower opening of cell, and proceed to clean two lower passes of cell in same manner as two upper passes.
 - (6.) Repeat the foregoing procedures until each cell in furnace has been cleaned.
 - (7.) Using vacuum cleaner, remove residue from each cell.
 - (8.) Using vacuum cleaner with soft brush attachment, clean burner assembly.
 - (9.) Reinstall flame radiators and burner assembly. Care must be exercised to center the flame radiators in the cell openings. Refer to furnace wiring diagram when reconnecting gas valve leads.
11. After cleaning flue openings, check sealant on flue collector to ensure that it has not been damaged. If new sealant is needed, contact your Distributor.
12. Reinstall flue choke. Be sure all screws are in place and tight.
13. Clean and replace flue collector assembly, making sure all eight screws are secure.
14. Replace four screws that secure the relief box to blower shelf.
15. Reconnect two wires to safeguard switch.

16. Reconnect wire harness edge connector to side of inducer control box.
17. Reconnect vent pipe to relief box, reinstall pipe enclosure.
18. Replace blower door only.
19. Turn on power and gas.
20. Set thermostat and check furnace for proper operation.
21. Check for gas leaks.
22. Replace control door.

▲ WARNING

Never use a match or other open flame to check for gas leaks. Use a soap-and-water solution. A failure to adhere to this warning can cause a fire, personal injury, or death.

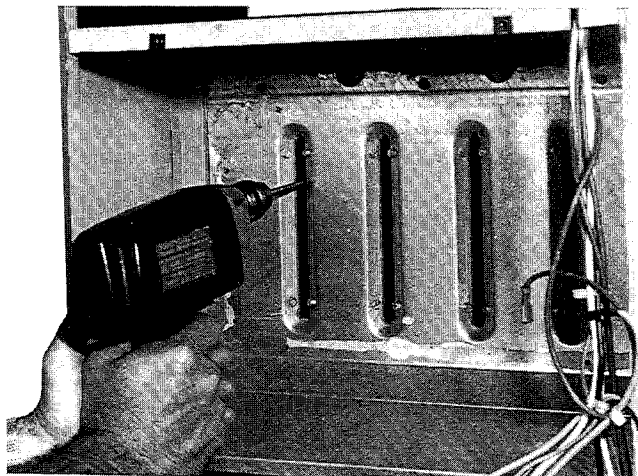
D. Pilot

Check the pilot and clean if necessary at the beginning of each heating season. The pilot flame should be high enough for proper impingement of the safety element and to light the burners. Remove the accumulation of soot and carbon from the safety element or sensing probe. See Fig. 19 and check electrode position.

E. Electrical Controls and Wiring

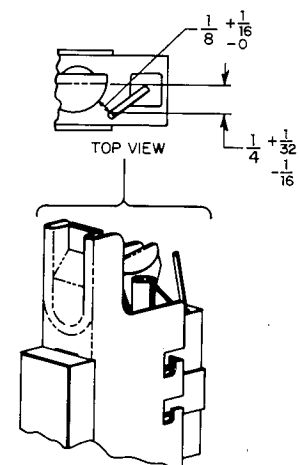
NOTE: There may be more than one electrical supply to unit.

With power disconnected to unit, check all electrical connections for tightness. Tighten all screws on electrical connections. If any smoky or burned connections are noticed, disassemble the connection, clean all parts and strip wire, and reassemble properly and securely. Electrical controls are difficult to check without proper instrumentation; therefore, reconnect electrical power to unit and observe unit through one complete operating cycle. If there are any discrepancies in the operating cycle, contact your Dealer and request service.



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Fig. 18—Cleaning Heat Exchanger Cell



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Fig. 19—Position of Electrode to Pilot

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